

CONCHYLIA

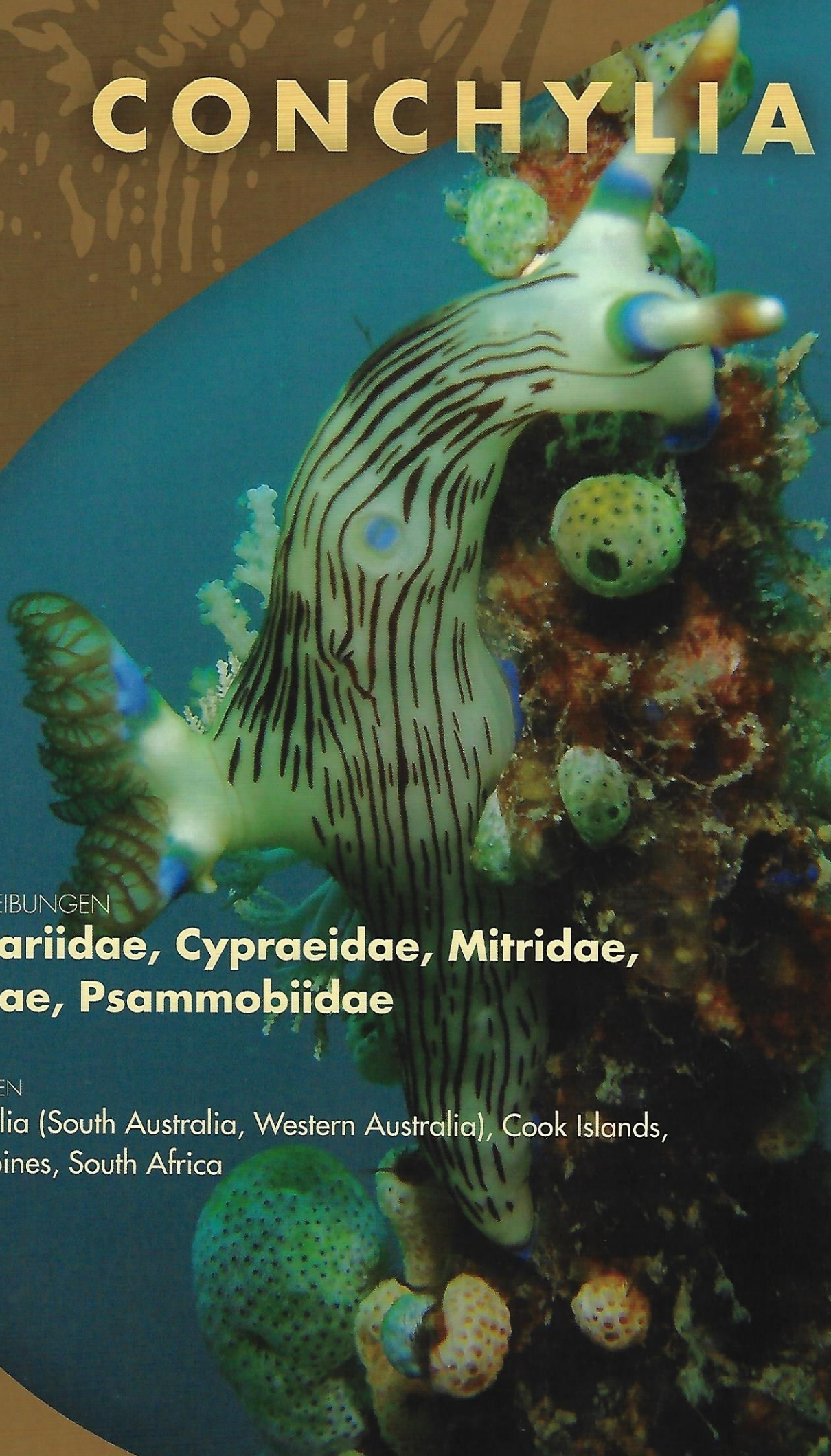
ISSN 1869-5302

NEUBESCHREIBUNGEN

Costellariidae, Cypraeidae, Mitridae, Ovulidae, Psammobiidae

REGIONEN

Australia (South Australia, Western Australia), Cook Islands,
Philippines, South Africa



Revision of *Mauritia maculifera* SCHILDER, 1932 in the Southeast Pacific with description of *Mauritia maculifera cookensis* n. ssp. (Mollusca: Gastropoda: Cypraeidae)

By ULF ERDMANN, D-Bad Sachsa & MICHAEL HART, NZ-Hutt Central

With 14 Text-Figures, 7 Tables and 16 Figures on 3 Plates

Keywords

Cypraeidae, cowries, statistical analysis, new subspecies.

Abstract

In the southeast Pacific Ocean there are two subspecies of *Mauritia maculifera* SCHILDER, 1932: *M. m. martybealsi* LORENZ, 2002 and *M. m. scindata* LORENZ, 2002. Populations of *Mauritia maculifera* from the Marquesas, Society and Tuamotu Islands are examined morphometrically and assigned to the subspecies *M. m. martybealsi* and *M. m. scindata* respectively. Subsequent shells from the Cook Islands are examined. They belong neither to *M. m. martybealsi* nor to *M. m. scindata* but are an own subspecies *Mauritia maculifera cookensis* n. ssp. Ring species status is proposed for *Mauritia maculifera* and the existing geographic subspecies are placed within this rassenkreis.

Zusammenfassung

Im Südostpazifik gibt es zwei Unterarten von *Mauritia maculifera* SCHILDER, 1932: *M. m. martybealsi* LORENZ, 2002 und *M. m. scindata* LORENZ, 2002. Populationen von *Mauritia maculifera* von den Marquesas-, Society- und Tuamotu-Inseln werden morphometrisch untersucht und den Unterarten *M. m. martybealsi* und *M. m. scindata* zugeordnet. Anschließend werden Schalen von den Cookinseln untersucht. Sie gehören weder zu *M. m. martybealsi* noch zu *M. m. scindata* und stellen eine eigene Unterart *Mauritia maculifera cookensis* n. ssp dar. Für *Mauritia maculifera* wird der Status einer Ringspezies vorgeschlagen und die bestehenden geografischen Unterarten werden in diesen Rassenkreis eingeordnet.

Abbreviations and Acronyms

- AMS Australian Museum, Sydney, Australia
HNC Haus der Natur, Cismar, Germany
MNHN Muséum national d'Histoire naturelle, Paris, France
NMNZ National Museum of New Zealand, Wellington, New Zealand
SMF Forschungsinstitut und Naturmuseum Senckenberg, Frankfurt a.M., Germany

coll. ERD Collection ERDMANN, Bad Sachsa, Germany

coll. HART Collection HART, Hutt Central, New Zealand

coll. LOR Collection LORENZ, Buseck, Germany

coll. TARR Collection TARRANT, Coffs Harbour, Australia

Introduction

In 2002 LORENZ was the first to point out, that *Mauritia maculifera* from the Marquesas Islands and from Tahiti each show several conchological differences versus populations from other places. Therefore, he established *Mauritia maculifera martybealsi* as new subspecies from the Marquesas Islands and *Mauritia maculifera scindata* as new subspecies from the Society and Tuamotu Islands.

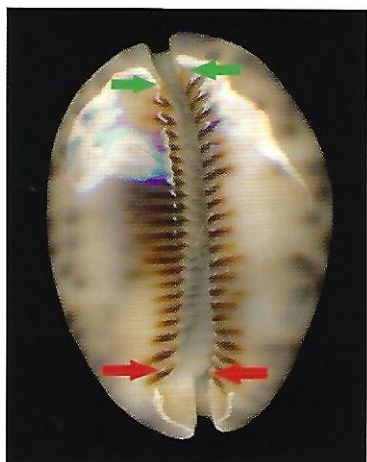
Material and Methods

482 specimens of *Mauritia maculifera* SCHILDER, 1932 were examined, enough to do a conclusive statistical analysis. Juvenile and distorted shells were excluded from the analysis.

The shells were measured according to the revised morphometric formula for the characterization of Cowries (BRIDGES & LORENZ 2013). Measurements of length, width, and height were taken with digital calipers and recorded to 0,01 mm accuracy. Measurements were repeated to exclude errors. The length of the shell was determined as the maximum dimension found. Likewise, width and height were measured as the maximum dimension along a plane approximately perpendicular to the maximum length and base, respectively.

The dentition was counted while viewing the shell under 5 × magnification. In all cases the terminal ridge of the columellar side was excluded from the counts as were any crenulations or ridges inside the posterior canal that did not become noticeable on the base. The first tooth counted on the labral side is the one opposite to the terminal ridge of the

columellar side (Text-Fig. 1). The last one is in the area where the labrum meets the columella.



Text-Fig. 1: Tooth counting; red arrow first tooth, green arrow last tooth.

Mass was recorded to the nearest 0.01 gram by weighing the samples using an electronic digital scale. Before weighing, all specimens were examined to make sure that they were dry, and did not contain any detritus or remains of the animal. The mass ratio was calculated as given by BRIDGES & LORENZ (2013).

For each sample of data, for example the length of shells, the average and the standard deviation was calculated. For comparing two samples of data, for example from different locations, the t-Test was used. In this way, it is possible to decide with a certain confidence (probably > 95 %, significant > 99 % and highly significant > 99,9 %), whether two sets of data are significantly different from each other or not (KAISER & GOTTSCHALK 1972).

Mauritia maculifera martybealsi

LORENZ 2002

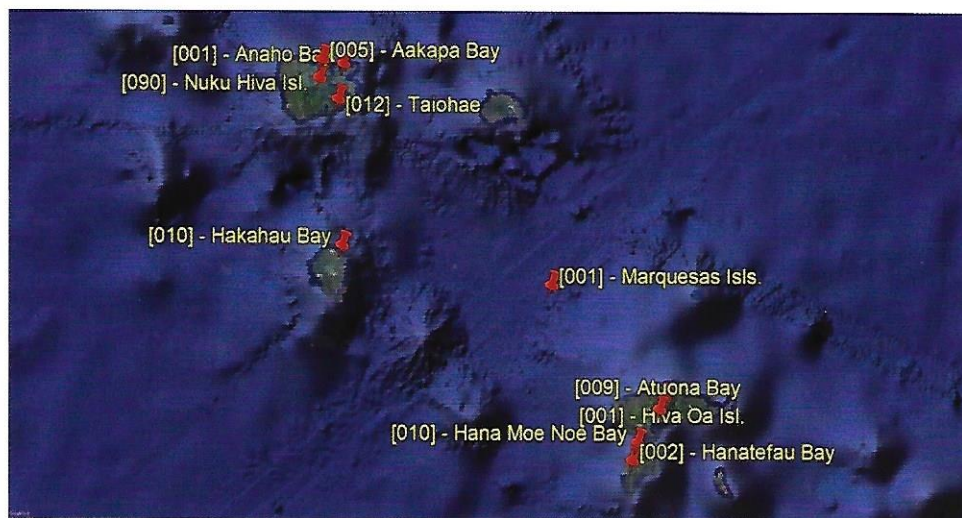
In 2002 LORENZ established this geographical subspecies from the Marquesas Islands (Text-Fig. 2).



Text-Fig. 2: Holotype *Mauritia maculifera martybealsi* LORENZ, 2002: Muséum national d'Histoire naturelle, Paris (France), MNHN-IM- 2000-3583.

A total of 141 shells was available for statistical analysis (Text-Figs 3, 4). All shells are in the first author's collection.

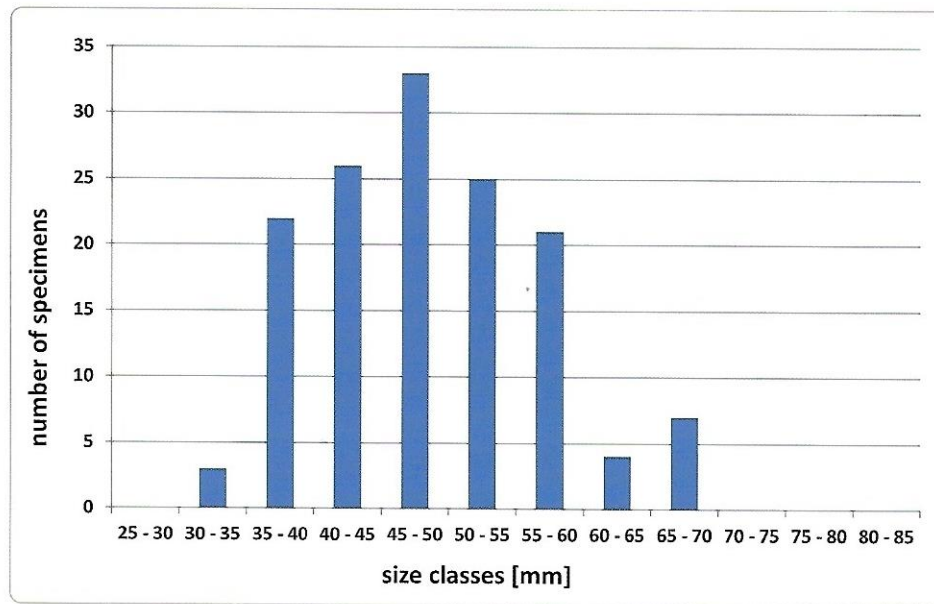
The shells originate – in alphabetical order – from Marquesas Islands (1); Aakapa Bay, Nuku Hiva Is. (5); Anaho Bay, Nuku Hiva Is. (1); Atuona Bay, Hiva Oa Is. (9); Hakahau Bay, Ua Pou Is. (10); Hana Moe Noe Bay, Tahuata Is. (10); Hanatefau Bay, Tahuata Is. (2); Hiva Oa Is. (1); Nuku Hiva Is. (90) and Taiohae Bay, Nuku Hiva Is. (12).



Text-Fig. 3: Finding localities of *M. maculifera martybealsi*.

The distribution of the shell lengths largely corresponds to the expected normal distribution. This is strong evidence that the shells present are morpho-

metrically representative of the subspecies. Statistical analysis of the 141 specimens reveals the following data (Tab. 1).



Text-Fig. 4: Standard distribution of the examined *M. maculifera martybealsi*.

Table 1: Morphometrical analysis of *Mauritia maculifera martybealsi* LORENZ, 2002.

Race	n	Minimum [mm]	Maximum [mm]	Rel. Width W/L [%]	Rel. Height H/L [%]	Rel. Height H/W [%]	Rel: Lab. Teeth	Rel. Col. Teeth	Mass Ratio
Marquesas	141	32,30	67,94	65,14 ± 4,48	50,08 ± 2,21	77,09 ± 3,88	18,39 ± 1,05	18,72 ± 1,25	18,65 ± 2,01

Mauritia maculifera scindata LORENZ, 2002

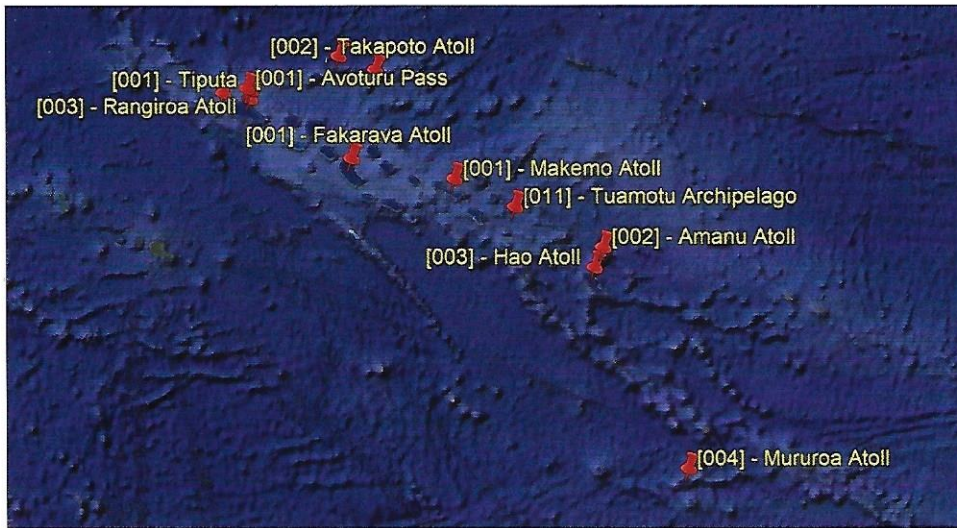
In 2002 LORENZ established this geographical subspecies from the Society and Tuamotu Islands (Text-Fig. 5).



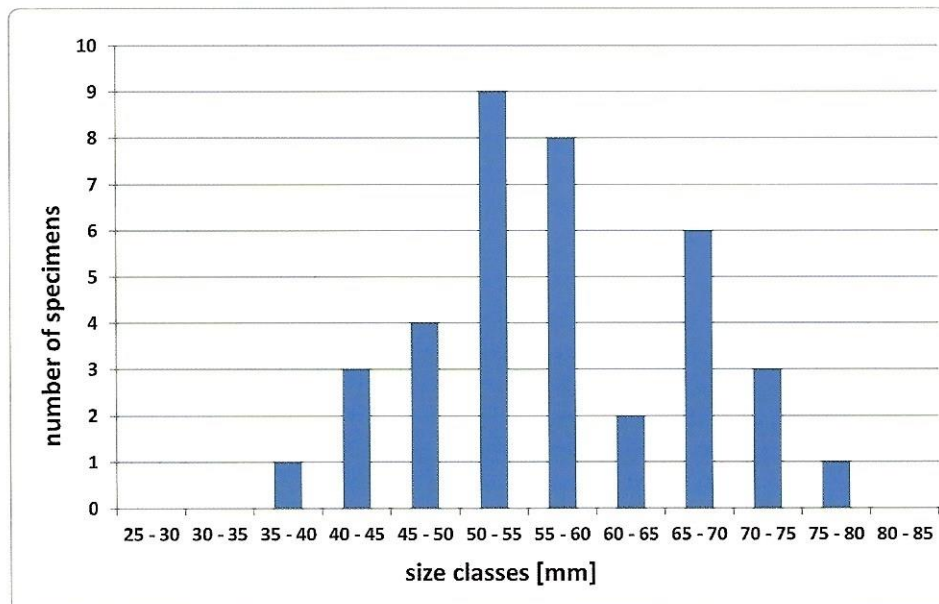
Text-Fig. 5: Holotype *Mauritia maculifera scindata* LORENZ, 2002; Muséum national d'Histoire naturelle, Paris (France), MNHN-IM- 2000-3604.

A total of 131 shells was available for statistical analysis, 37 specimens from Tuamotu Islands (Text-Figs 6, 7), 94 specimens from Society Islands (Text-Figs 8, 9). All shells are in the first author's collection.

The shells from the Tuamotus originate – in alphabetical order – from the Tuamotus Archipelago in general (11); Amanu Atoll, Hao Group (2); Avoturu Pass, Rangiroa Atoll, Palliser Islands (1); Fakarava Atoll, Palliser Is. (1), Hao Atoll (3), Makemo Atoll, Raeffsky Islands (1), Manihi Atoll, King George Islands (1), Moruroa Atoll, Far East Group (4); Rangiroa Atoll, Palliser Islands (3); Takapoto Atoll, King George Islands (2), Tikehau Atoll, Palliser Islands (7), and Tiputa, Rangiroa Atoll, Palliser Islands (1).



Text-Fig. 6: Finding localities of *M. maculifera scindata*, Tuamotu Islands.



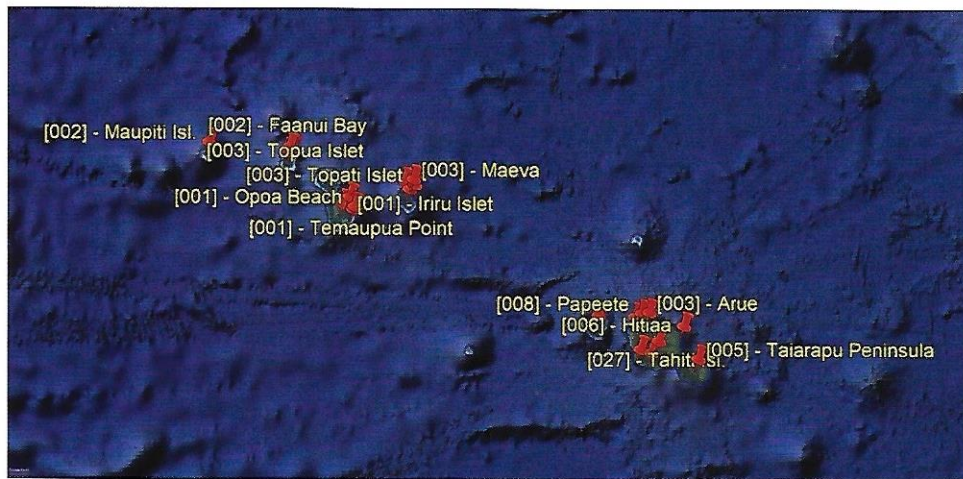
Text-Fig. 7: Standard distribution of the examined *M. m. scindata*, Tuamotu Islands.

The distribution of the shell lengths largely corresponds to the expected normal distribution, although there is a lack of specimens in the size class of 60-65 mm. This lack may be due to the relatively small number of shells available from this region. Nevertheless, there is evidence that the shells studied are morphometrical representatives of the subspecies from this region.

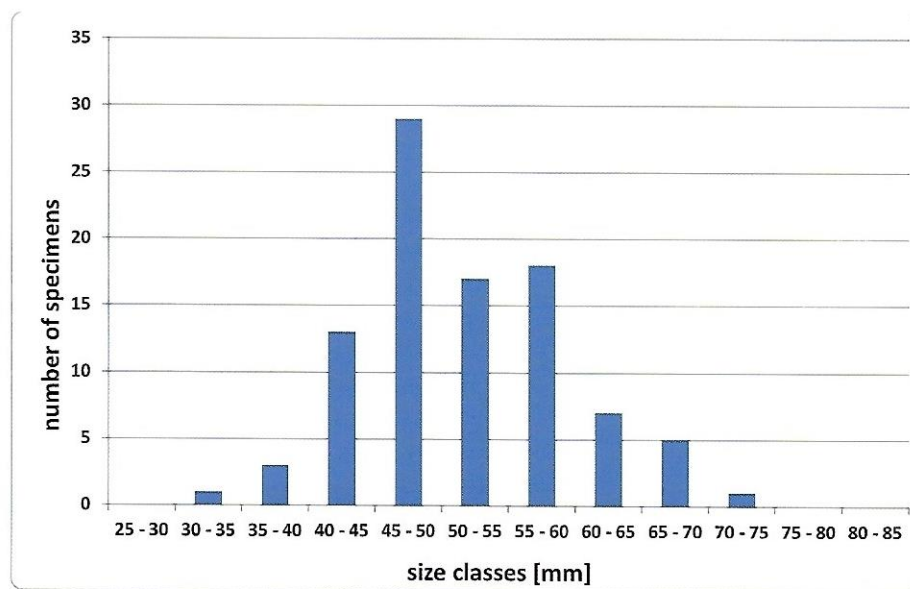
The shells from the Society Islands originate – in alphabetical order – from Arue, Tahiti Is. (3); Bora Bora Is. (2); Faa, Tahiti Is. (1); Faanui Bay, Bora Bora Is. (2); Fare, Huahine Is. (1); Hitiaa, Tahiti Is. (6); Huahine Is. (18), Iriru Is., Raiatea Is. (1); Maeva, Huahine Is. (3); Maupiti Is. (2); Moorea Is.

(2); Maara, Tahiti Is. (1); Opoa Beach, Raiatea Is. (1); Papara, Tahiti Is. (1); Papeete, Tahiti Is. (8); Raiatea Is. (3); Tahiti Is. (27); Tairapu Peninsula, Tahiti Is. (5); Témaupua Point, Bora Bora Is. (1); Topua Islet, Bora Bora Is. (3); and Topati Islet, Huahine Is. (3).

Statistical analysis of the 94 specimens reveals the data shown below (tab. 2). The distribution of the shell lengths largely corresponds to the expected normal distribution. This is strong evidence that these shells are morphometrically consistent with those characteristic of the subspecies from this region.



Text-Fig. 8: Finding localities of *M. maculifera scindata*, Society Islands.



Text-Fig. 9: Standard distribution of the examined *M. m. scindata*, Society Islands.

Table 2: Morphometrical analysis of *Mauritia maculifera scindata* LORENZ, 2002.

Origin	n	Minimum [mm]	Maximum [mm]	Rel. Width W/L [%]	Rel. Height H/L [%]	Rel. Height H/W [%]	Rel: Lab. Teeth	Rel. Col. Teeth	Mass Ratio
Tuamotus	37	39,29	79,13	69,17 ± 3,13	51,06 ± 2,39	73,86 ± 2,53	17,27 ± 0,97	17,88 ± 1,16	20,81 ± 2,76
Society	94	34,38	71,48	68,72 ± 2,82	50,99 ± 1,91	74,27 ± 3,16	17,92 ± 0,92	18,15 ± 1,13	21,55 ± 2,75

Statistical comparison of the populations of the Society and Tuamotu Islands applying the t-Test revealed highly significant difference in one of the examined parameters namely the relative number of labral teeth. All other parameters examined do not show any statistically relevant differences, but rather agreement. Therefore, the occurrence of

Mauritia maculifera scindata in the Society and Tuamotu Islands is proven, just as proposed in the original description. Consequently, based on this conchological analyses, the two populations can be considered as the same coherent subspecies LORENZ named *scindata* (Tab. 3).

Table 3: Morphometrical analysis of *Mauritia maculifera scindata* LORENZ 2002.

Race	n	Minimum [mm]	Maximum [mm]	Rel. Width W/L [%]	Rel. Height H/L [%]	Rel. Height H/W [%]	Rel: Lab. Teeth	Rel. Col. Teeth	Mass Ratio
Society & Tuamotu	131	34,38	79,13	68,85 ± 2,92	51,01 ± 2,05	74,16 ± 3,00	17,74± 0,98	18,08 ± 1,15	21,34 ± 2,77

***Mauritia maculifera* from Cook**

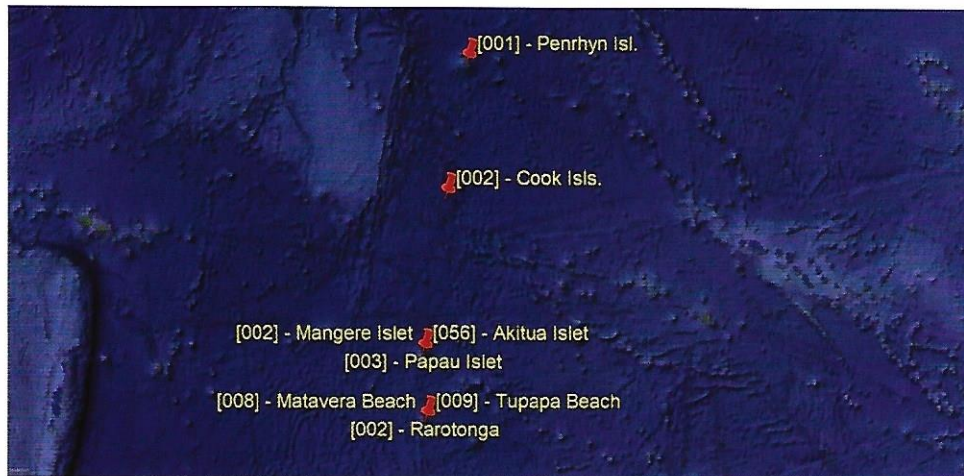
The Cook Islands are not mentioned as area of distribution for *Mauritia maculifera scindata* in the original description by LORENZ (2002). Because of the geographic proximity, it was assumed that the population of *maculifera* from the Cook Islands also belongs to the subspecies of *maculifera scindata*. In his latest book, LORENZ (2017a) expands the distribution area of *M. m. scindata* to the west across the Cook Islands to New Caledonia and states that the shells from the western range show conchological differences in comparison to those from the eastern area around the Society Islands and the Tuamotu Archipelago. LORENZ depicts four shells from the Cook Islands on plates 86 and 87, which show the characteristic features of the western population (2017b) recognized as distinct herein.

To investigate this further, 211 specimens from Cook Islands have been morphometrically

examined (Text-Fig. 10). 30 Shells are in the collection of FELIX LORENZ, 1 shell in the collection of DAVID TARRANT, 180 shells are in the first author’s collection.

The shells from the Cooks Islands originate – in alphabetical order from the Cook Islands in general (2); Aitutaki Lagoon, Aitutaki Atoll (80), Akitua Islet, Aitutaki Atoll (104), Mangere Islet, Aitutaki Atoll (2); Matavera Beach, Rarotonga Is. (8); Papau Islet, Aitutaki Atoll (3); Penrhyn Is. (1); Rarotonga Is. (2); and Tupapa Beach, Rarotonga Is. (9).

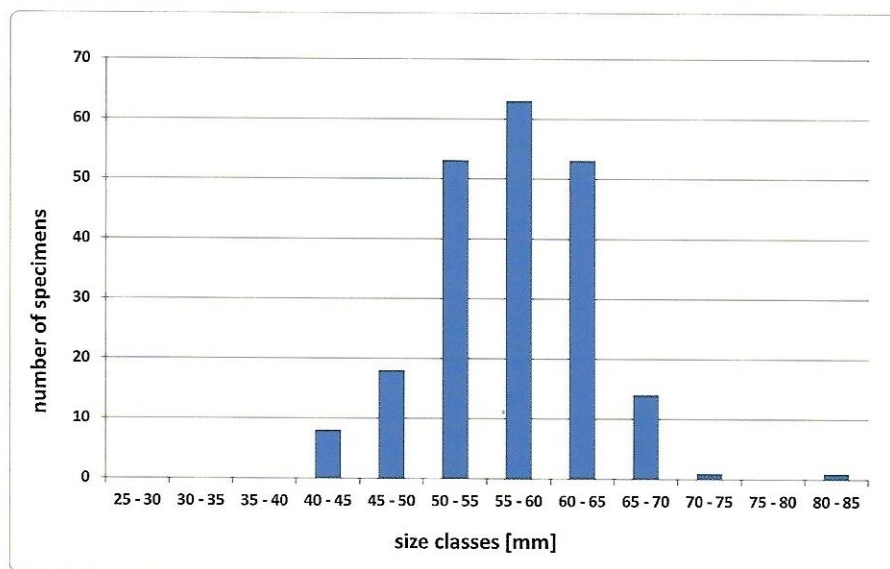
The distribution of the shell lengths largely corresponds to the expected normal distribution. This is strong evidence that the shells present are morphometrically representative of the subspecies from this region. Statistical analysis of the 211 specimens reveals the following data (Tab. 4).



Text-Fig. 10: Finding localities of *Mauritia maculifera* from the Cook Islands.

Table 4: Morphometrical analysis of *Mauritia maculifera* from Cook Islands.

Origin	n	Minimum [mm]	Maximum [mm]	Rel. Width W/L [%]	Rel. Height H/L [%]	Rel. Height H/W [%]	Rel: Lab. Teeth	Rel. Col. Teeth	Mass Ratio
Cook	211	40,16	81,28	69,12 ± 2,56	52,58 ± 1,86	76,14 ± 3,13	18,33 ± 0,91	18,20 ± 1,05	21,11 ± 1,60



Text-Fig. 11: Standard distribution of the examined *M. maculifera* from the Cook Islands.

Statistical comparison of *Mauritia maculifera martybealsi*, *M. m. scindata* and *M. maculifera* from Cook Islands

In the following, the data of the three populations are being compared (Tab. 5).

Table 5: Morphometrical analysis of *Mauritia maculifera* in the Southeast Pacific Ocean

Race	n	Minimum [mm]	Maximum [mm]	Rel. Width W/L [%]	Rel. Height H/L [%]	Rel. Height H/W [%]	Rel: Lab. Teeth	Rel. Col. Teeth	Mass Ratio
Marquesas	141	32,30	67,94	65,14 ± 4,48	50,08 ± 2,21	77,09 ± 3,88	18,39 ± 1,05	18,72 ± 1,25	18,65 ± 2,01
Society & Tuamotu	131	34,38	79,13	68,85 ± 2,92	51,01 ± 2,05	74,16 ± 3,00	17,74 ± 0,98	18,08 ± 1,15	21,34 ± 2,77
Cook Isl	211	40,16	81,28	69,12 ± 2,56	52,58 ± 1,86	76,14 ± 3,13	18,33 ± 0,91	18,20 ± 1,05	21,11 ± 1,60

T-test analysis reveals significant differences between the different populations (Tab. 6).

Comparing *Mauritia maculifera martybealsi* and *Mauritia maculifera scindata* reveals statistical differences in all examined parameters. All of them are highly significantly different (> 99,9 %). This proves *Mauritia maculifera martybealsi* and *Mauritia maculifera scindata* to represent two different subspecies based also on morphometrical analyses.

Comparing *Mauritia maculifera martybealsi* and *Mauritia maculifera* from the Cook Islands reveals mostly statistical differences. The relative height in comparison to the width differs only slightly (> 95 %), while the other parameters tested proved

highly significant (> 99,9 %), except for the relative number of labral teeth, which does not seem to differ (< 95 %). The overall data proves that *Mauritia maculifera martybealsi* and *Mauritia maculifera* from the Cook Islands also belong to different subspecies.

Comparing *Mauritia maculifera scindata* and *Mauritia maculifera* from the Cook Islands also reveals statistical differences. Probably no differences exist in the relative width, in the relative number of columellar teeth, and the mass ratio (< 95 %). On the other hand, the relative number of labral teeth and both relative heights are different by high significance (> 99,9 %). This denotes that *Mauritia maculifera scindata* and *Mauritia maculifera* from

the Cook Islands are clearly distinguishable morphometrically. As there are further conchological features that distinguish shells from

the Cook Islands, this hitherto un-named population is described as a new subspecies:

Table 6: Statistical comparison of *Mauritia maculifera* in the Southeast Pacific Ocean. W/L = relative width, H/L = relative height, H/B = relative breadth, r lab tee = relative number of labral teeth, r col tee = relative number of columellar teeth, mass rat = mass ratio.

	Society & Tuamotu		Cook	
	<i>M. m. scindata</i>		<i>(M. m. cookensis n. ssp.)</i>	
Marquesas <i>M. m. martybealsi</i>	W/L	> 99,9 %	W/L	> 99,9 %
	H/L	> 99,9 %	H/L	> 99,9 %
	H/W	> 99,9 %	H/W	> 99 %
	r lab teeth	> 99,9 %	r lab teeth	< 95 %
	r col teeth	> 99,9 %	r col teeth	> 99,9 %
	mass ratio	> 99,9 %	mass ratio	> 99,9 %
Society & Tuamotu <i>M. m. scindata</i>	-	-	W/L	< 95 %
	-	-	H/L	> 99,9 %
	-	-	H/W	> 99,9 %
	-	-	r lab teeth	> 99,9 %
	-	-	r col teeth	< 95 %
	-	-	mass ratio	< 95 %

***Mauritia maculifera cookensis* n. ssp.**

Etymology

The species is named for its type locality, the Cook Islands.

Material

180 specimens in coll. ERD, including among others 159 shells from Aitutaki Atoll and 18 Shells from Rarotonga Is., mainly personally collected and provided by – in alphabetical order – BERNARD C. COTTON (Australia), ANDREA & ULF ERDMANN (Germany), CHARLES GEERTS (Belgium), MICHAEL HART (New Zealand), BRIAN HAYES (USA), GARY LESKE (Australia), FELIX LORENZ (Germany), LUCA MAGLIARO (Italy), JOCHEN-PETER SALTIN (Germany).

1 specimen in coll. TARR from Rarotonga Is., personally collected.

30 specimens in coll. LOR from Aitutaki-Atoll, personally collected and provided by MICHAEL HART (New Zealand).

Holotype: 61.3 × 40.8 × 31.2 mm (23:26) [46.33 g] Akitua Islet, Aitutaki, SMF-373148.

Paratype 1: 64.3 × 41.4 × 32.6 mm (26:26) [49.62 g], Akitua Islet, Aitutaki, NMNZ-M.334511.

Paratype 2: 60.8 × 41.2 × 3 2.5 mm (26:25) [45.77 g], Akitua Islet, Aitutaki, MNHN-IM-2012-25397.

Paratype 3: 59.8 × 40.1 × 30.2 mm (24:23) [49.17 g], Akitua Islet, Aitutaki, HNC-121231.

Paratype 4: 58.6 × 40.9 × 31.7 mm (25:24) [46.57 g], Akitua Islet, Aitutaki, AMS-C.548208.

Paratype 5: 49.7 × 35.0 × 25.9 mm (25:22) [29.45 g], Aitutaki Atoll, coll. ERD CypR-49449.

Paratype 6: 71.3 × 48.2 × 39.2 mm (28:27) [62.49 g], Akitua Islet, Aitutaki, coll. ERD CypR-49473

Paratype 7: 58.7 × 40.4 × 29.6 mm (25:26) [45.39 g], Papau Islet, Aitutaki, coll. ERD CypR-46465

Paratype 8: 60.9 × 42.6 × 30.2 mm (24:23) [53.99 g], Akitua Islet, Aitutaki, coll. HART.

Paratype 9: 60.0 × 39.5 × 31.7 mm (23:26) [41.55 g], Akitua Islet, Aitutaki, coll. LOR.

Paratype 10: 62.6 × 42.7 × 35.0 mm (25:23) [55.51 g], Akitua Islet, Aitutaki, coll. LOR.

Paratype 11: 66.1 × 45.4 × 32.9 mm (25:24) [65.99 g], Penrhyn Is., coll. ERD CypR-12198.

Paratype 12: 60.7 × 43.1 × 33.4 mm (25:27) [54.67 g], Matavera Beach, coll. ERD CypR-42295

Given are the absolute length, width and height, the number of relative labral and columellar teeth, and the weight for the Holotype and the 12 paratypes. There are 168 additional paratypes in the author's collection and additional 28 paratypes in FELIX LORENZ' collection and 1 paratype in DAVID TARRANT's collection.

Description

The shell is oval-elongate, the dorsum is slightly humped towards the posterior end. The shell is widest in the middle. A prominent marginal callus surrounds the shell. The spire is exposed and pointed, the whorls are discernible through the posterior callosities. The anterior extremity is nearly without processes, the posterior extremities are short, rounded, and callused. The base is convex and strongly calloused. It shows different shades of cream. The aperture is very narrow, rather straight, slightly curved to the left posteriorly, not widening anteriorly. The dorsal background colour is brownish-grey with three indistinct darker transverse zones of nearly equal width. The teeth are dark chestnut brown and rather thick. The labral teeth are restricted to the aperture along most of its length, getting longer towards the anterior end. The columellar teeth are even shorter, also restricted to the aperture, only 5 teeth extend slightly near the middle of the shell. The dark staining of the teeth somewhat extends. The fossula is greyish-white, produced and slightly projecting, taking half of the aperture's total length. The columellar ridge and the fossula are densely ribbed.

The margins are coloured yellow-brown towards the dorsum and greyish to the edges. They are crowded with numerous dark spots which become smaller towards the base. The spots reach far onto half of the base on each side. The basal blotch is small and indistinct. The dark brown reticulated dorsal netting leaves distinct lacunae of variable size. The mantle line is not quite straight, running in the middle of the dorsum.

There is little variation in the characteristics described above among the paratypes. The basal blotch is nearly always indistinct and often absent (Pl. 1, Fig. 4: Paratype 3). The reticulated pattern can be more pronounced so that the lacunae are rather small (Pl. 2, Fig. 11: Paratype 11; Fig. 12: Paratype 12). Sometimes the lateral spots only extend to the edge of the base and not further onto the base itself (Pl. 2, Fig. 11: Paratype 11).

Type Locality

The type locality is Akitua Islet, East Aitutaki Atoll, Southern Cook Islands.



Text-Fig. 12: Akitua Is. at low tide, habitat of *maculifera cookensis* n. ssp. in shallow water in front of the coast line, photo by MICHAEL HART.

Habitat and distribution

According to observations of the second author, who collected all the material examined from Aitutaki Atoll, *Mauritia maculifera cookensis* n. ssp. is found under slabs of dead and live coral in shallow water (Fig. 12). In its natural habitat *M. m. cookensis* n. ssp. is preyed upon by eagle rays. They crush the shells for the animals inside and leave the pieces of the shells on the ground (Fig. 13).



Text-Fig. 13: Fragments of *Mauritia maculifera cookensis* n. ssp., crushed by eagle rays; collected by MICHAEL HART.

Discussion

Table 7 below shows an extensive comparison of the three *maculifera* subspecies occurring in Polynesia.

The main characteristics of *maculifera cookensis* n. ssp. are the greater relative height compared to the length as well as their pronounced lateral callus, the very clearly convex base, the indistinct to absent basal blotch and the shorter, more rounded posterior extremities. Compared to its direct neighbour *maculifera scindata* there is also the significantly greater relative height compared to the width and the significantly higher number of relative columellar teeth.

The distribution of *Mauritia maculifera* in the Pacific Ocean is an interesting phenomenon. The name *maculifera* was introduced by SCHILDER in 1932 to replace the invalidly introduced *reticulata* MARTYN, 1784 and the preoccupied *maculata* BARNES, 1824. The type-locality of *reticulata* was given as “Friendly Islands”, which is another name for Tonga, but also several other Pacific Islands. In 1962 and 1965 SCHILDER logically designated Tonga as Type locality.

But there is one problem. Although single specimens of *maculifera* from the Central Pacific Ocean appear from time to time, the existence of an established population of *maculifera* in this area has not been conclusively proven. The first author made collecting expeditions to Fiji, Samoa and Tonga and never found a specimen, neither himself nor on the local shell markets, although he found plenty of them in the Tuamotus, Society Island, and the Cook Islands. The second author did extensive collecting in Samoa, and also never found a specimen there.

Thomas MARTYN himself stated in 1784 that he was showing “the figures of shells (most of them rare and nondescript) which have been collected by several officers of the ships under the command of Captain Byron, Wallis, Cook, and others made to the South Sea”.

Captain James COOK was killed on his third voyage in Hawaii 1779. The two expedition ships Resolution and Discovery returned from their last voyage to London in 1780. At that time, members of the ship’s crew earned extra income by selling items collected during the voyage, including shells. This time, two thirds of the shells went to Thomas

MARTYN, a knowledgeable dealer, versatile writer and gifted artist. MARTYN didn’t want the shells for profit, although he did resell some of them, but used them as motives for his book ‘The Universal Conchologist’. Besides the specimens originating from COOK’s voyages, MARTYN included specimens from the collections of the Duchess of Portland, the Countess of Bute, John HUNTER, the FORSTERS, and others. The localities given in his book are likely based on guesses, including the locality assigned to *Cypraea reticulata*. Therefore changing the locus typus for *Mauritia maculifera* from Tonga to Hawaii is a logical consequence, as MARTYN’s illustration resembles the unmistakable Hawaiian population of *maculifera* remarkably well. The original illustration and description of *reticulata* as such should not be used as evidence for the occurrence of *maculifera* in the Central Pacific.

Mauritia maculifera could be a so-called ring species or “Rassenkreis”. This term describes a complex of geographic subspecies that is distributed in a ring shape across a large area. The neighbouring subspecies are not genetically isolated from each other, so they may hybridize. After populations dispersed along a circular area, they may be reproductively isolated (= separate species) by the time the two extremes of the species’ distribution (the ends of the “ring”) re-join. *M. maculifera cookensis* n. ssp. in this context would be an evolutionary relatively young subspecies that was separated from *M. maculifera scindata*. The ring would then be formed around the *maculifera*-empty Central South Pacific by counterclockwise (cfr. Text-Fig. 14):

M. maculifera cookensis n. ssp. in Cook Islands

M. maculifera scindata LORENZ, 2002 in Society and Tuamotu Islands

M. maculifera martybealsi LORENZ, 2002 in Marquesas Islands, separated in earlier times

M. maculifera maculifera SCHILDER, 1932 in Hawaiian Islands, and from Marshall Islands to Guam

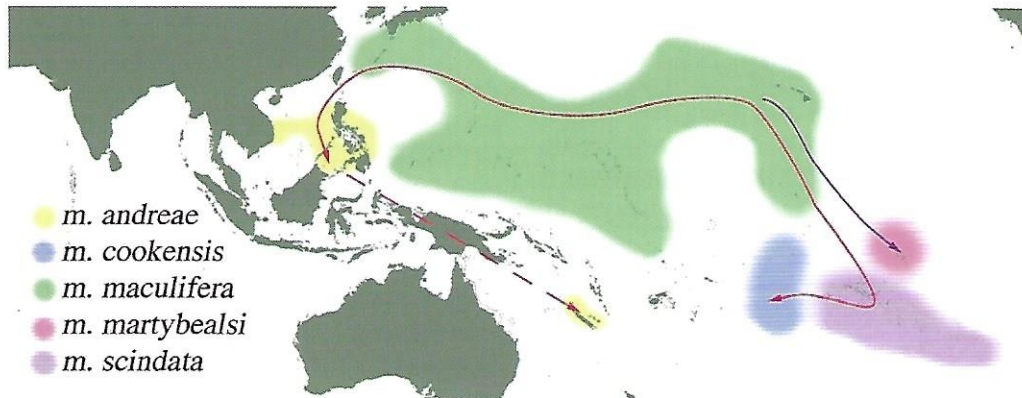
M. maculifera andreae ERDMANN & LORENZ, 2017 from the Philippine Islands to New Caledonia.

Table 7: Comparison of the three *maculifera* subspecies occurring in Polynesia.

	<i>M. maculifera martybealsi</i>	<i>M. maculifera scindata</i>	<i>M. maculifera cookensis</i>
general shape	rhomboidal, broadly callused, wider, more depressed, widest midways, the dorsum is slightly humped towards the posterior (65.14 % / 50.08 % / 77.09 %)	oval-elongate, slight marginal callus, widest midways, dorsum rather flat, not humped (68.85 % / 51.01 % / 74.16 %)	oval-elongate, more prominent marginal callus, widest midways, the dorsum is slightly humped towards the posterior (69.13 % / 52.56 % / 76.10 %)
extremities	anterior extremity forms pointed processes, the posterior solid and rostrate	anterior extremity with spiny processes, posterior blunt and callused	anterior extremity mostly without processes, posterior short and rounded
spire	completely covered by posterior extremity	slightly exposed, pointed	more exposed and pointed
aperture	very narrow, rather straight, slightly curved posteriorly, slightly widening anteriorly	very narrow, rather straight, slightly curved posteriorly, not widening anteriorly	very narrow, rather straight, slightly curved posteriorly, not widening anteriorly
teeth	rather fine, restricted to the apertural margin, their black staining proceeds onto both sides, on the columellar side distinctly longer in the middle of the shell, labrally about equally longer throughout (18.39 / 18.72)	rather thick, restricted to the aperture along most of its length, slightly extend posteriorly on the columellar side, their black staining proceeds onto both sides, on the columellar side distinctly longer in the middle of the shell, labrally about equally longer throughout (17.74 / 18.08)	dark chestnut brown, rather thick, labral teeth restricted to the aperture along most of its length, slightly extended posteriorly on the columellar side, their black staining proceeds onto both sides, on the columellar side distinctly longer in the middle of the shell, labrally about equally longer throughout (18.33 / 18.20)
fossula	plain white, produced, slightly projecting, taking half of the aperture's total length; columellar peristome and fossula densely ribbed	greyish-white, produced, slightly projecting, taking half of the aperture's total length; columellar peristome and fossula densely ribbed	greyish-white, produced, slightly projecting, taking half of the aperture's total length; columellar peristome and fossula densely ribbed
dorsum	background color purplish-grey, with three indistinct darker transverse zones	background color brownish-grey, with three very indistinct darker transverse zones	background color brownish-grey, with three very indistinct darker transverse zones
dorsal pattern	brown, reticulated netting, leaving circular lacunae of variable size; straight dorsal line	dark brown, compact reticulated netting, forming smaller lacunae; dorsal line distinct, slightly moved to the left side of the dorsum	dark brown, reticulated netting, often leaving distinct lacunae of variable size; variable dorsal line
margins	bluish to black towards the dorsum, cream around the edges numerous black spots, confluent, getting smaller basally	pale grey to cream crowded small darker spots that reach far onto the base	yellow-brown towards the dorsum, greyish at the edges numerous black spots, becoming smaller at the base, reaching far onto the base
base	pale cream to grey, orange along the aperture slightly convex and callused, indistinct darker blotch on either side of the aperture midways	rather pale, cream to bluish grey convex and callused, rather distinct basal blotch on the left side of the aperture	different shades of cream convex and even more calloused, basal spot on left side of the aperture smaller and more indistinct, often only traces or even absent

The two ring ends currently would be *maculifera cookensis* n. ssp. on the one hand and *maculifera andreae* on the other. Further studies may show whether the theory of a ring species is applicable for *maculifera*. For the time being, there is a lack of evidence for populations to occur between the

Philippines and New Caledonia. If they exist at all, shells from the area between New Caledonia and the Cook Islands would also be required to add substance to the theory. If a collector has the appropriate shells, we are happy to evaluate them.



Text-Fig. 14: Distribution of ring species *Mauritia maculifera* SCHILDER, 1932; changed after LORENZ 2017.

Acknowledgements

Many thanks to Felix LORENZ (Buseck, Germany) and David TARRANT (Coffs Harbour, Australia) for critical reading and discussing the manuscript.

References

BARNES, D. H. (1824): Notice of several species of shells. – *Annals of the Lyceum of Natural History of New York*, **1** (1): 131-140, pl. IX.

BRIDGES, R. J. & LORENZ, F. (2013): A Revised Morphometric Formula for the Characterization of Cowries (Gastropoda: Cypraeidae). – *Conchylia*, **43** (1-4): 23-36

KAISER, R. & GOTTSCHALK, G. (1972): Elementare Tests zur Beurteilung von Messdaten. – pp. 25-27, 48-49., Mannheim (Bibliographisches Institut).

LORENZ, F. (2002): New worldwide cowries. Descriptions of new taxa and revisions of selected groups of living *Cypraeidae* (Mollusca: Gastropoda). 2. The subspecies of *Mauritia maculifera* and *M. scurra*. – *Schriften zur Malakozoologie*, **20**: 1-292, pls 1-41. [p. 17-23, pls 3-4].

LORENZ, F. (2017a): Cowries. A Guide to the Gastropod Family Cypraeidae. 1. Biology and Systematics. – 644 pp. Harxheim, Germany (ConchBooks) [pp. 313-315].

LORENZ, F. (2017b): Cowries. A Guide to the Gastropod Family Cypraeidae. 2. Shells and Animals. – 715 pp. Harxheim, Germany (ConchBooks) [pp. 180-183].

MARTYN, Thomas: The Universal Conchologist. Vol. 1. – London, 1784. – fig. 15.

SCHILDER, F. A. (1932): Beiträge zur Kenntnis der Cypraeacea V. – *Zoologischer Anzeiger*, **100**: 164-165.

SCHILDER, F. A. (1962): Type Localities. – *The Veliger*, **4** (4): 199-202.

SCHILDER, F. A. (1965): The type localities of living Cypraeidae. – *Malakologische Abhandlungen*, **2** (14): 193-233.

Addresses of the authors:

ULF ERDMANN
Finkenweg 17
37441 Bad Sachsa, Germany
E-mail: uverdmann@aol.com

MICHAEL HART
5 Colin Grove
Hutt Central 5010, New Zealand
E-mail: antipodeanshells@gmail.com

Received: 8. May 2023

Accepted: 16. October 2023

Plate 1 (on page 62)

- Fig. 1:** *M. maculifera cookensis* n. ssp. – 61.3 mm – Akitua Islet, Aitutaki Atoll, Holotype – SMF-373148
Fig. 2: *M. maculifera cookensis* n. ssp. – 64.3 mm – Akitua Islet, Aitutaki Atoll, Paratype 1 – NMNZ-M.334511
Fig. 3: *M. maculifera cookensis* n. ssp. – 60.8 mm – Akitua Islet, Aitutaki Atoll, Paratype 2 – MNHN-IM-2012-25397
Fig. 4: *M. maculifera cookensis* n. ssp. – 59.8 mm – Akitua Islet, Aitutaki Atoll, Paratype 3 – HNC-121231

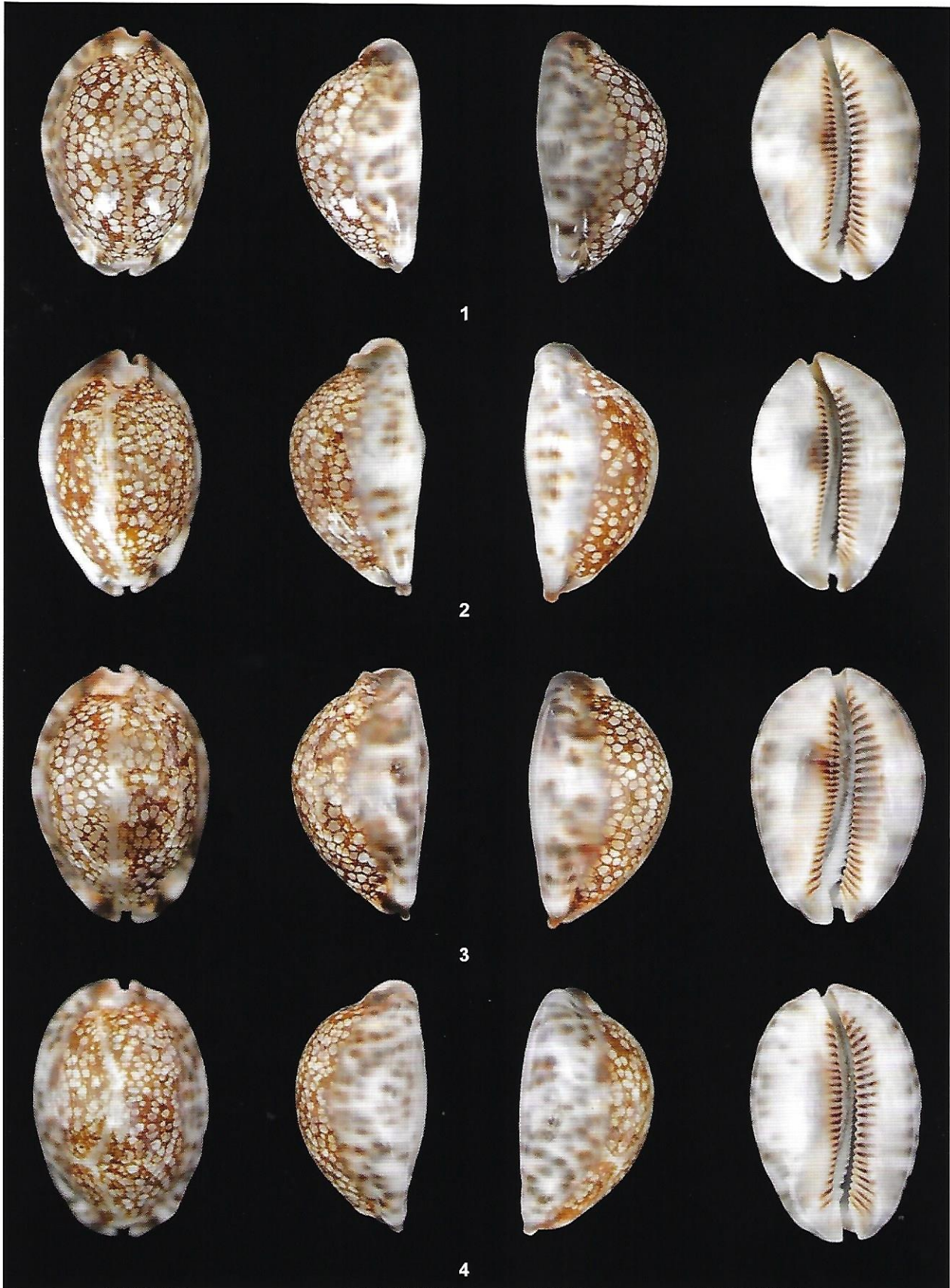
Plate 2 (on page 63)

- Fig. 5:** *M. maculifera cookensis* n. ssp. – 58.6 mm – Akitua Islet, Aitutaki Atoll, Paratype 4 – AMS-C.548208
Fig. 6: *M. maculifera cookensis* n. ssp. – 49.7 mm – Akitua Islet, Aitutaki Atoll, Paratype 5 – Coll. ERD CypR-49449
Fig. 7: *M. maculifera cookensis* n. ssp. – 71.3 mm – Akitua Islet, Aitutaki Atoll, Paratype 6 – Coll. ERD CypR-49473
Fig. 8: *M. maculifera cookensis* n. ssp. – 58.7 mm – Papau Islet, Aitutaki Atoll, Paratype 7 – Coll. ERD CypR-46465
Fig. 9: *M. maculifera cookensis* n. ssp. – 60.8 mm – Akitua Islet, Aitutaki Atoll, Paratype 8 – Coll. HART
Fig. 10: *M. maculifera cookensis* n. ssp. – 60.0 mm – Akitua Islet, Aitutaki Atoll, Paratype 9 – Coll. LOR
Fig. 11: *M. maculifera cookensis* n. ssp. – 66.1 mm – Penrhyn Isl, Cook Islands, Paratype 11 – Coll. ERD CypR-12198
Fig. 12: *M. maculifera cookensis* n. ssp. – 60.7 mm – Matavera, Rarortonga Is., Paratype 12 – Coll. ERD CypR-42295

Plate 3 (on page 64)

- Fig. 13:** *M. maculifera martybealsi* LORENZ 2002 – 54.9 mm – Hanatefau Bay, Tahuata Is. – Coll. ERD CypR-49446
Fig. 14: *M. maculifera scindata* LORENZ 2002 – 54,5 mm – Avoturu Pass, Rangiroa Atoll – Coll. ERD CypR-37234
Fig. 15: *M. maculifera scindata* LORENZ 2002 – 45.5 mm – Faaa, Tahiti Is., Society Islands – Coll. ERD CypR-01828
Fig. 16: *M. maculifera cookensis* n. ssp. – 61.3 mm – Akitua Islet, Aitutaki Atoll, Holotype – SMF-373148

Plate 1



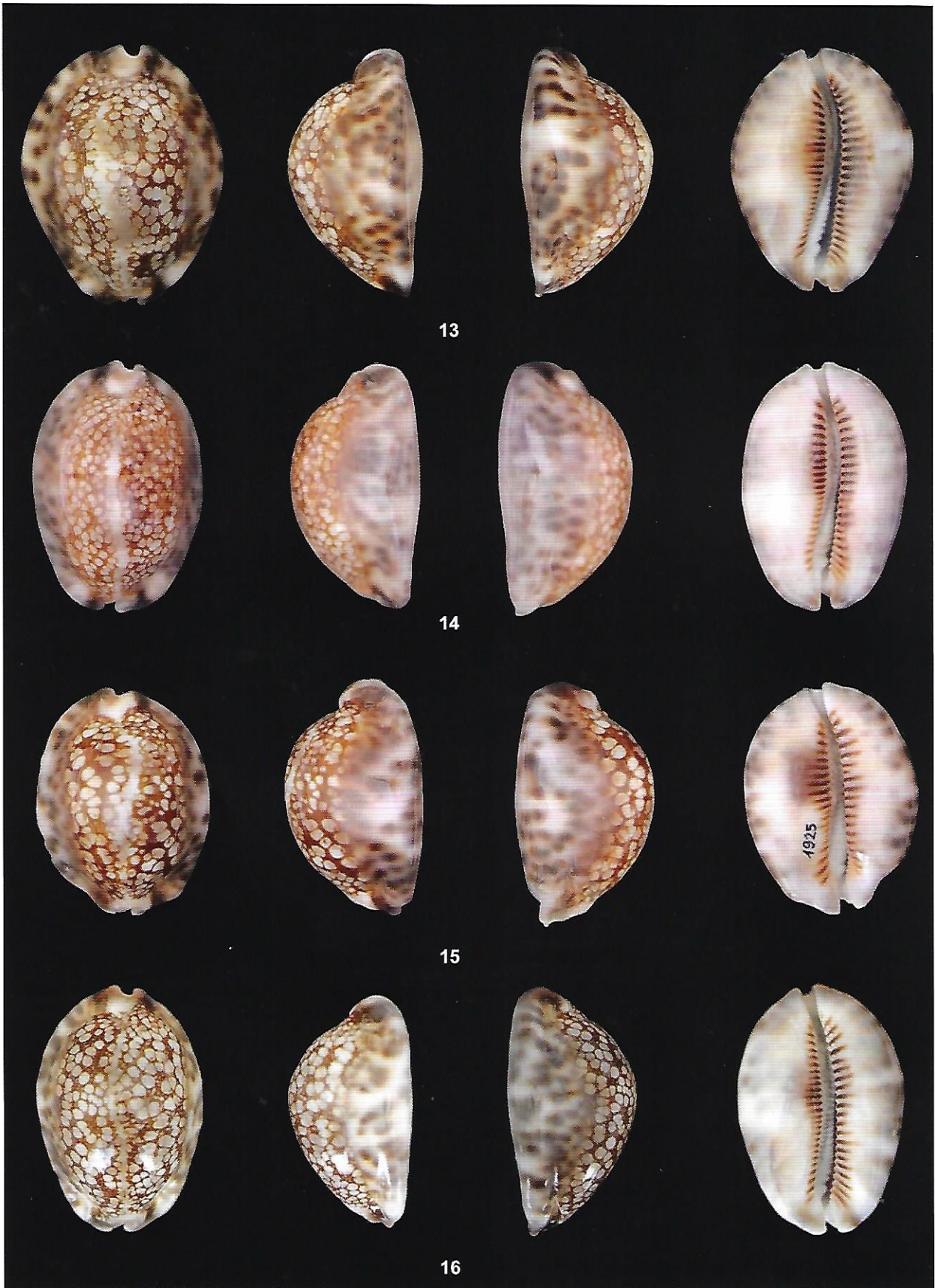
Explanation on page 61

Plate 2



Explanation on page 61

Plate 3



Explanation on page 61